

WHAT IS CLAIMED IS:

*Sub A27*

1. An imaging device for imaging radiation, said  
2 imaging device comprising a semiconductor substrate  
3 including an array of detector cells which generate charge  
4 in response to incident radiation and a corresponding  
5 readout semiconductor substrate including an array of  
6 readout cells, said readout cells being connected to  
7 corresponding detector cells by low temperature solder  
8 bumps.

1. 2. The imaging device of claim 1 wherein said  
2 solder bumps comprise solder having a melting point under  
3 180°C.

1. 2. The imaging device of claim 1 wherein said  
2 solder bumps comprise solder having a melting point under  
3 120°C.

1. 2. The imaging device of claim 1 wherein said  
2 solder bumps comprise solder having a melting point under  
3 100°C.

1. 2. The imaging device of claim 1 wherein said  
2 solder bumps comprise lead-tin based solder having a  
3 melting point below that of eutectic lead-tin solder.

1. 2. The imaging device of claim 1 wherein said  
2 solder bumps comprise solder including Bi, Pb, and Sn.

1. 2. The imaging device of claim 1 wherein said

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2 solder bumps comprise solder comprised of approximately 52  
3 percent Bi, approximately 32 percent Pb and approximately  
4 16 percent Sn.

1        8. The imaging device of claim 1 wherein said  
2 solder bumps comprise solder comprised of Bi and Pb and  
3 between 1 and 65 percent Sn.

1        9. The imaging device of claim 1 wherein said  
2 solder bumps comprise solder comprised of Bi and Sn and  
3 between 1 and 75 percent Pb.

1        10. The imaging device of claim 1 wherein said  
2 solder bumps comprise solder comprised of Pb and Sn and  
3 between 1 and 75 percent Bi.

1        11. The imaging device of claim 1 wherein said  
2 solder bumps comprise a solder alloy including at least  
3 one of In, Cd, Ga, Zn, Ag or Au.

1        12. The imaging device of claim 1 wherein said  
2 detector substrate comprises CdZnTe.

~~13.~~ The imaging device of claim 1 wherein said detector substrate comprises CdTe.

1            14. An imaging system comprising:

*10(B7)* an imaging device for imaging radiation, said imaging device comprising an array of detectors which generate charge in response to incident radiation and an array of readout devices

6 connected to corresponding elements of said  
7 array of detectors by low temperature solder  
8 bumps;  
9 control electronics operably coupled to said imaging  
10 device for controlling reading by said readout  
11 devices and processing output from said readout  
12 devices; and  
13 an image processor responsive to processed output  
14 from said control electronics for generating an  
15 image therefrom.

15. The imaging system of claim ~~14~~ <sup>13</sup> wherein each of  
1 said detectors is a detector cell on a semiconductor  
2 substrate.

16. The imaging system of claim ~~14~~ <sup>13</sup> wherein each of  
1 said readout devices is a readout cell on a next  
2 semiconductor substrate.

17. The imaging system of claim ~~14~~ <sup>13</sup> wherein said  
1 control electronics comprise analog to digital converters.

18. The imaging system of claim ~~17~~ <sup>17</sup> <sup>14</sup> wherein said  
2 control electronics further comprise data reduction  
3 processors.

19. A method of manufacturing an imaging device  
1 comprising a detector semiconductor substrate including an  
2 array of detector cells for generating charge in response  
3 to incident radiation and a readout semiconductor  
4 substrate including an array of readout cells, one of said  
5

6 detector cells and one of said readout cells forming an  
7 image cell, said method comprising:

8 applying low temperature solder bumps to one of said  
9 substrates at positions corresponding to said  
10 image cells;

11 aligning respective readout and detector cells to  
12 each other; and

13 connecting said detector and said readout cells by  
14 the application of heat to said low temperature  
15 solder bumps.

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1 20. The method of claim 19 wherein said solder bumps  
2 are applied to said readout substrate at positions  
3 corresponding to said readout cells.

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1 21. The method of claim 19 wherein said solder bumps  
2 are applied to said readout substrate at positions  
3 corresponding to said readout cells and to said detector  
4 substrate at positions corresponding to said detector  
5 cells.

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1 22. The method of claim 19 wherein said solder bumps  
2 comprise solder having a melting point under 180°C.

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1 23. The method of claim 19 wherein said solder bumps  
2 comprise solder having a melting point under 120°C.

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1 24. The method of claim 19 wherein said solder bumps  
2 comprise solder having a melting point under 100°C.

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1 25. The method of claim 19 wherein said solder bumps

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Cont

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2 comprise a solder alloy of Bi, Pb, and Sn.

1           26. The method of claim <sup>18</sup> ~~19~~ wherein said solder bumps  
2 comprise a solder alloy of approximately 52 percent Bi,  
3 approximately 32 percent Pb, and approximately 16 percent  
4 Sn.

1           27. The method of claim <sup>18</sup> ~~19~~ wherein said solder bumps  
2 comprise solder comprised of Bi and Pb and between 1 and  
3 65 percent Sn.

1           28. The method of claim <sup>18</sup> ~~19~~ wherein said solder bumps  
2 comprise solder comprised of Bi and Sn and between 1 and  
3 75 percent Pb.

1           29. The method of claim <sup>18</sup> ~~19~~ wherein said solder bumps  
2 comprise solder comprised of Pb and Sn and between 1 and  
3 75 percent Bi.

1           30. The method of claim <sup>18</sup> ~~19~~ wherein said solder bumps  
2 comprise a solder alloy including at least one of In, Cd,  
3 Ga, Zn, Ag or Au.

1           <sup>19</sup> <sup>18</sup> 31. The method of claim <sup>18</sup> ~~19~~ wherein said solder is an  
2 alloy having a plurality of constituent elements and said  
3 step of applying low temperature solder bumps comprises:  
4           applying constituent elements of said low temperature  
5           solder in required proportions at positions for  
6           said solder bumps; and  
7           applying heat to reflow said constituent elements to  
8           form said solder bumps.

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